NERL Internal Fact Sheet

September 21, 2016

Legacy and emerging perfluoroalkyl substances in the Cape Fear River Watershed of North Carolina: Occurrence and fate during conventional and advanced water treatment processes

Impact Statement

The USEPA's recently completed Unregulated Contaminant Monitoring Rule 3 (UCMR3) program and many other state and Regional monitoring efforts have demonstrated that the occurrence of poly- and perfluoroalkyl substances (PFASs) in surface, ground, and drinking water resources is a growing concern for many communities. This manuscript documents the occurrence of PFAS in the largest watershed in North Carolina in 2013 - 2014. Results indicate that legacy PFAS, such as perfluorooctane sulfonate (PFOS) and perfluorooctanoic acid (PFOA), continue to be significant issue. Additionally, many new "replacement" PFAS can now be found in surface and drinking water resources in this basin. Analysis of water samples collected at one community's drinking water plant shows that conventional treatment processes have a negligible effect on PFAS removal. Additional laboratory-based experiments document the performance of a powdered activated carbon (PAC) adsorbent on the removal of legacy and replacement PFAS from drinking water resources.

Background

PFAS such as PFOS and PFOA have been in widespread use in industrial formulations and consumer products for more than sixty years. PFOS, PFOA, and related compounds have been found to be persistent, bioaccumulative, and toxic. PFOS has been listed as a controlled substance under the Stockholm Convention and PFOA has been linked to endocrine dysfunction, immunotoxicity, cancer, and other serious health effects in humans. USEPA and other regulatory bodies worldwide have worked effectively to limit the production and distribution of long-chain PFAS, but their long production history, environmental persistence, and potential for bioaccumulation ensure that they will remain a concern well into the future. The USEPA recently issued Health Advisories for PFOS and PFOA in drinking water (sum of both not to exceed 70 ng/L). A new generation of "replacement" PFAS is now being used in place of the legacy contaminants. The occurrence and characteristics of these newer compounds remain undocumented.

Objective and Results

- PFOS and PFOA measured in the source water at one drinking water treatment plant (Community A) above the USEPA health advisory level (70 ng/L for the sum of PFOS and PFOA) on 57 of 127 sampling days.

- In the source water of a drinking water treatment plant (Community C, downstream of a PFAS manufacturer), the mean concentration of perfluoro-2-propoxypropanoic acid (PFPrOPrA or GenX), a replacement for PFOA, was 631 ng/L (n = 37). Six other perfluoroalkyl ether carboxylic acids (PFECAs) were detected with three exhibiting chromatographic peak areas up to 15 times that of PFPrOPrA.

- At the drinking water treatment plant in Community C, PFECA removal by coagulation, ozonation, biofiltration, and disinfection was negligible.

- In laboratory experiments, PFAS adsorbability on PAC increased with increasing chain length but replacing one CF2 group with an ether oxygen decreased PFAS affinity for PAC, while replacement of additional CF2 groups with ether oxygens did not lead to further affinity changes.

Status

The manuscript is undergoing internal Agency review and is intended for submission to *Environmental Science & Technology Letters.*

Publication

M. Sun, E. Arevalo, M.J. Strynar, A.B. Lindstrom, and D.R.U. Knappe, "Legacy and emerging perfluoroalkyl substances in the Cape Fear River Watershed of North Carolina: Occurrence and fate during conventional and advanced water treatment processes," for submission to *Environmental Science & Technology Letters.*

Contacts

Timothy J. Buckley, PhD
Director of the Exposure Methods & Measurements Division
National Exposure Research Laboratory
(919) 541-2454 or buckley.timothy@epa.gov